

# Plans for MTOR upgrade to full field in full volume

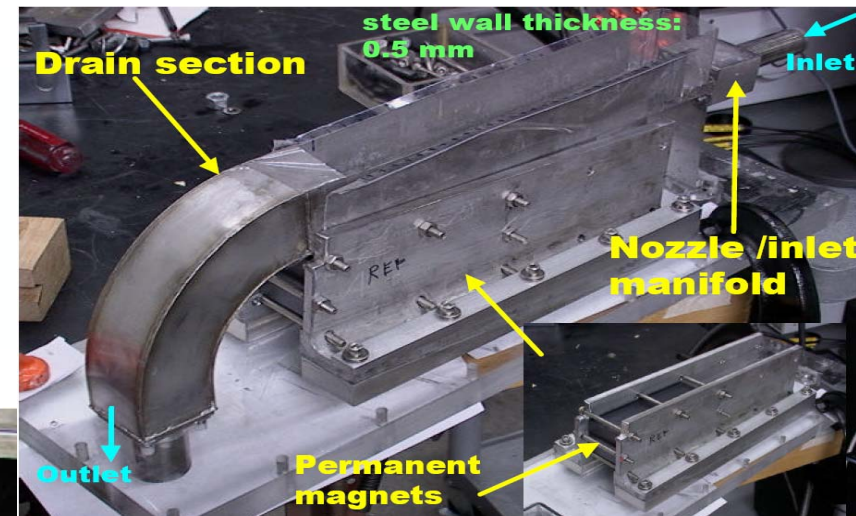
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**ALPS/PFC Meeting**  
**Oakbrook, IL, November 19, 2003**

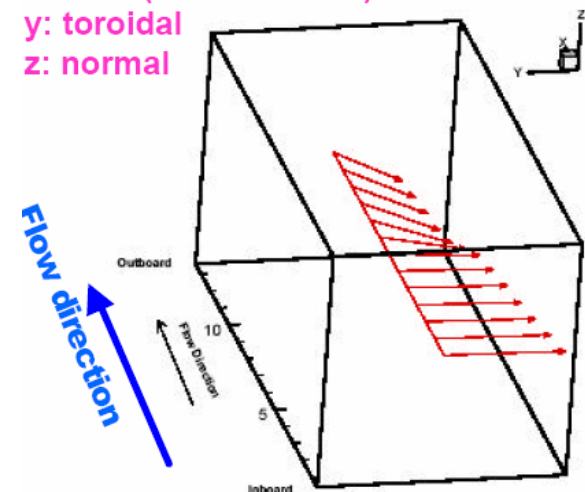
# Some Specific Details on the Recent Experimental Study

**The goal was to quantify the film height variation-**

Width of the channel limited to about 7 cm if max B of 1.2 T is to be reached



x: axial (flow direction)  
y: toroidal  
z: normal



# Why do we need/want larger volumes at high field in MTOR

## PFC/ALPS/ALIST Module B MHD research

- **Nearer term experiments needed to explore wide film flows for NSTX module B (competing effects of large aspect ratio films make this area unknown – HIMAG will be working on it soon)**
- **Nearer term experiments needed to explore closely-spaced jet array formation from common manifold systems in the relevant (high) magnetic field**
- **Large magnetic system for NSTX module B qualification and shakedown testing**

## Blanket/APEX Complex Closed Channel MHD research

# How can we get high field over larger volume in MTOR?

- **Current size of MTOR-NSTX LSM test article limited by the need of using iron flux concentrator**
- **We have been considering options for two years for how to operate at high field over large volumes**
  - **pulsed operation with liquid N2 cooled magnets**
  - **pulsed operation with arrays of batteries or capacitors**
  - **steady operation with addition of large amounts of iron closing more than  $\frac{1}{2}$  of the torus**
  - **steady operation with lab AC power upgrade and new power supply**

# What is needed for the preferred option of new power supply

## **Preface**

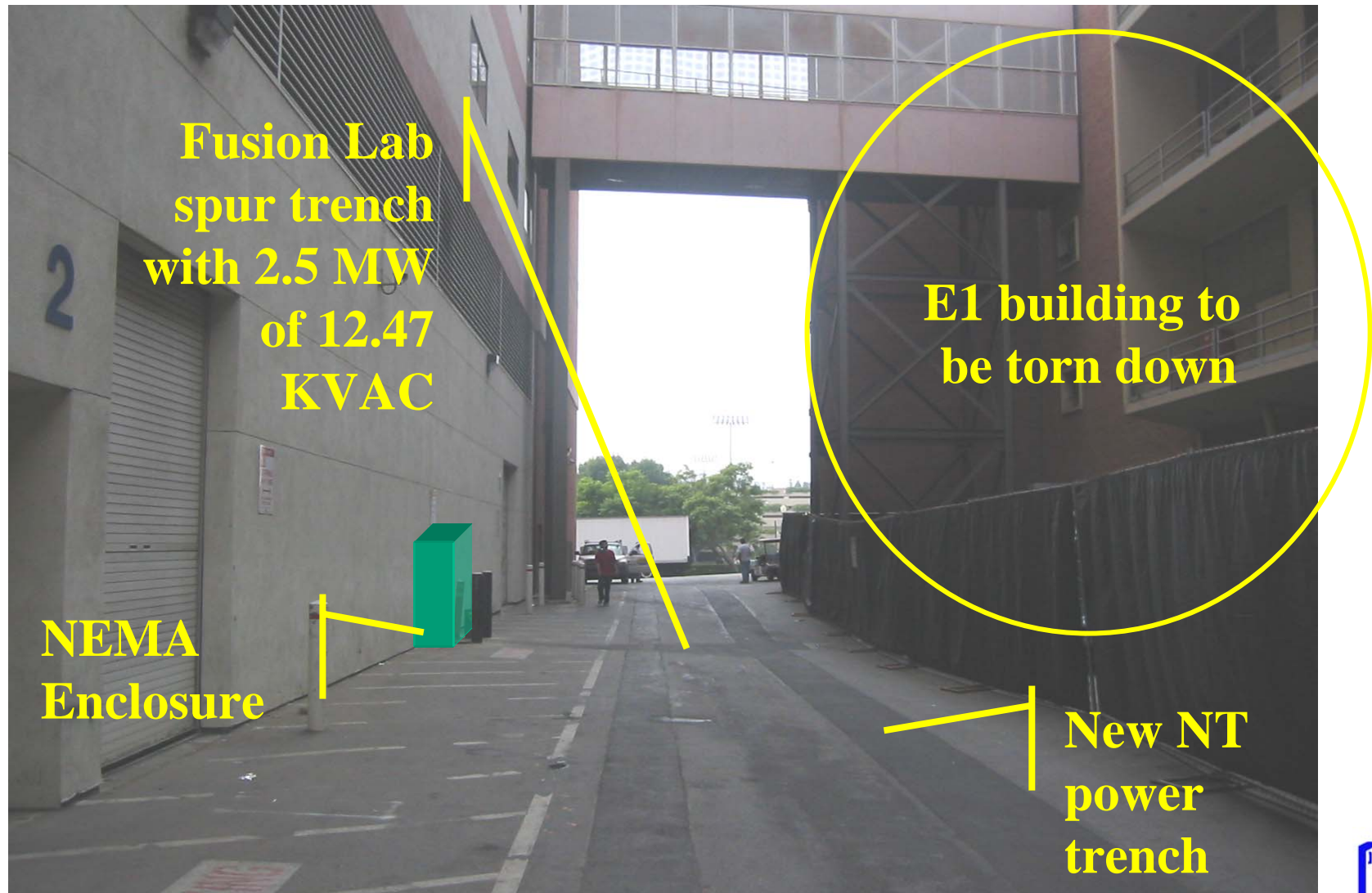
**Power upgrade to MTOR was proposed at last November meeting. However, it did not going forward due to a significant amount of money needed. The estimated total cost was > \$400 k, with a power upgrade to the lab of \$250k and a power supply of \$150 to 200 k.**

## **What happened since then?**

**The E1 building at UCLA is to be torn down and the new Nano-technology building replacing it will be switched to the 12.47 kV line, requiring a power trench down the alley right in front of our lab.**

**This provided an opportunity for us to bring the 12.47kV line into the lab. The cost was \$40k (in stead of \$250k) and we convinced the dean to pay the cost as an infrastructure upgrade.**

## 2.5MW fusion power upgrade piggy-backed of Nanotech building project



# Request Details

Now, it appears reasonable to ask for a power upgrade to MTOR (to run at its full capacity).

**What do we need additionally?**

12.47 KV  
termination box –  
above grade, north  
wall of 15-125

(\$40k, done)

Load Limiting  
Reactor Inductor

(optional, \$0k)

Full load  
Interrupter Switch

12.47kV to DC  
rectifying power  
supply

DC disconnect  
switch

All components integrated into Power supply unit, \$200k)

The biggest amount will be spent on the rectifier power supply, which transforms an input voltage of 12.47kV to an output current of 3664Adc (MTOR full coil current). **The quote for this from the SatCon Power Systems Canada Ltd. is \$175.5k.** There are other miscellaneous costs such as an ~\$20k for conduit and cable needed in the lab, and cooling system modifications

# Power supply detail

## 2.75MW Thyristor Rectifier Power Supply

- Input Voltage: 12.47kV
- Output 3664Adc
- Enclosure: NEMA 1 (Estimated Dims: 90”H x 108”W x 84”D)
- Integrated primary side LI switch



# Request Details (Cont'd)

## Specific Request

- It is requested that the \$200k needed for the rectifier power supply system to be shared and paid by the APEX unallocated fund and ALPS the discretionary money.
- A written request (document 3) has been provided to the ALPS SC for this purpose.
- For FY2004 the proposed request is \$100k, while the remaining \$100k shall be provided in FY2005. The upgrade will be spread over two years and completed in FY05

## The absolute minimum bottom line

**\$50 K** from FY04 ALPS/PFC discretionary money  
(with assurance of similar funds in FY05)